

User-Friendly Power Extension with Bluetooth-Controlled and IR Sensor for Switching

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Abstract: This paper's aim is to present innovation of user-friendly power extension project by utilizing the extended application of Android Smartphone through Bluetooth technology in controlling the switching operation. In addition, IR sensors also have been used in order to provide a second option to control its operation. One of the major concerns while handling the power extension is the importance of safety procedure. Some users might just turn ON/OFF the power extension with a wet hand. This may lead to electric shock. In other cases, the user may forget to turn OFF the power extension, especially while using it with other electric or electronic appliances such as iron, heater and etc. Therefore, this project may provide one alternative in solving the cases. This project applies two methods of controlling the power extension. User can choose which method prefers in controlling the device. The first controlling method is by using an Android smartphone to turn ON and turn OFF the switch from the distance by using the Bluetooth application. Arduino Bluetooth Control Device apps were used to control the switch and to set the timer. The signal from the apps was sent to the Arduino microcontroller via HC-05 Bluetooth module. Then the 4-channel relay was used to transfer control signals from the microcontroller to each socket of power extension for switching on/off action. For the second method, the Infrared Sensors were used to control the switch ON and OFF operation. The other process involved is similar to the first controlling method. Lastly, the LCD display was used to display, which switch is ON or OFF. The LCD display according to the input received from the Arduino. Initially, the switch will be in OFF condition and the LCD will show 'Friendly Extension'. When the user press button 'Switch 1' at the smartphone or put a finger in front of the Infrared Sensor 'Switch 1' for a while, the Arduino will turn ON the switch of the socket and the LCD will show 'SWITCH 1 ON' a while and then the LCD display will show 'FRIENDLY EXTENSION' again. To turn OFF, the user just needs to press again the same button or put the finger in front of the same Infrared Sensor. Therefore, the LCD display will show 'SWITCH 1 OFF' for a while and it will show 'FRIENDLY EXTENSION' again. The LCD will display the result based on which input is selected by the user. In conclusion, the user-friendly power extension provides two options for the user in controlling a typical power extension either by using a smartphone or IR sensor together with the application of Arduino Mega and Bluetooth module.

Keywords: Power Extension, Bluetooth module, Arduino Mega, IR sensor, 4 - Channel Relay

1.0 INTRODUCTION

Nowadays, a smartphone is an important gadget in our daily lives. The smartphone has been used to make a call and sent or receive messages. Most of the people use their smartphone every day to surf the internet and interact in social media, check emails, manage calendars, listen to music, play games, take photos, read the news and others. However, the use of a smartphone can be extended to controlling any other electrical and electronic appliances.

One of the home applications today that is still using

the normal way is switched on/off the single socket of power extension. It is considered a normal way because the users need to manually switch on/off the sockets by walk according to how far and height the power extension place. This problem can be achieved by using the smartphone and also combined with the electronic component such as any sensor for control techniques of power extension.

The User - Friendly Power Extension is one of equipped with electrical and electronic devices that can be controlled power extension for every single socket to switch on/off by two methods in one time which is using smartphone via the

Bluetooth and sensor as the second method. Users just need to use their smartphone and control the power extension by “Arduino Bluetooth Control Device” application. The project also provides a timer for each socket power extension if users want to set how long to switch on the socket extension and then the socket of power extension will be automatically switched off after the timer is over.

The second method to control the sockets of the power extension is by using the IR sensor. The step to control the sockets of power extension is users approached their hand near to the IR sensor to switch on and approached one more time to switch off. This method also as a backup way to control power extension when the smartphone was shut down because out of battery.

Last but not least, User - Friendly Power Extension used the same concept with a remote control but just the controllers are different and advance because Friendly Power Extension using a smartphone via the Bluetooth and IR sensor.

2.0 LITERATURE REVIEW

As this project is the first kind of innovation for a power extension [1], therefore the literature review will be only on focusing only the fundamental theory of the following knowledge:

Power Extension

Power extension has been used to extend the electrical power from the main electricity supply via wall sockets or another power extension and connects to the electrical appliances. Normal power extension has up to 5 2-pin or 3-pin socket to connect the electrical appliances or another extension. The manual switch was used to control the switch of power extension. The output of the power extension is 230v.

Arduino Based Home Automation

Home automation was used to control electrical appliances or devices. The Arduino [2] as the based to control the relay in this project and then the relay will act as the switch to supply the power to appliances or devices. Home automation can be control by using the smartphone that will be connected via Bluetooth module and control the relay remotely with the smartphone, to control it the user must use apps called “Bluetooth Controller” that can be downloaded at Android Play Store.

iDevices Smart Wall Outlet

This smart wall outlet was produced by iDevices [3] that can be controlled using Wi-Fi [4] and has Google Assistant compatibility. This device can be controlled by using voice

commands through Siri, Alexa, and the Google Assistant. iDevices Smart Wall Outlet has energy monitoring to monitor the energy that’s been used.

Bluetooth Connection

According to Christensson, P. (2006). Bluetooth Definition. Retrieved 2017, Nov 22, from <https://techterms.com> [5], Bluetooth is a wireless technology enables communication between Bluetooth-compatible devices. It can be used for short-range connections between desktop and laptop computers, PDAs, digital cameras, scanners, cellular phones, and printers. Implemented of Bluetooth can be seen in Arduino Based Home Automation. The Bluetooth module is connected to the microcontroller and smartphone. The Bluetooth connection could be connected with a range of 30 meters to 50 meters. But Bluetooth connection can only interact with one device at a time only and Bluetooth connection has high power consumption, batteries of the device drain quickly when Bluetooth connection is on then it is off, the device's batteries need to recharge or replace frequently.

Arduino Bluetooth Control Device Application

Arduino Bluetooth Control Device [6] is a simple tool to help users control the Arduino Mega [7] from Android Smartphone via the HC-05 Bluetooth serial module. This application already has the switch and timer programs. We choose this application as shown in Figure 1.1 because it has an additional program which is timer programs. The maximum time is 4 hours and the minimum is 1 minute if users want to set.

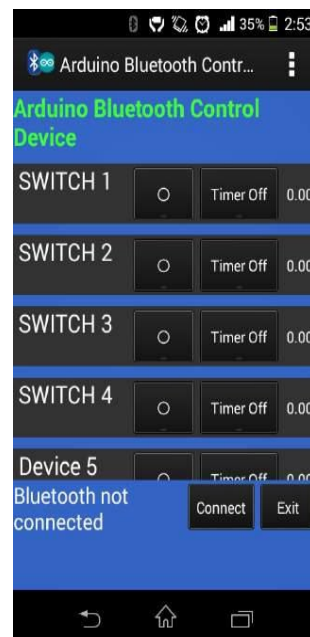


Figure 1.1: Arduino Bluetooth Control Device Application

Literature review studies also reveal that this project provides

a significant impact to society by providing an alternative solution in improvising the current technology of power extension available in the market.

Table 1.1 represents the strength of a few types of power extension available in the market as compared to the current project.

Table 1.1 Types of Power Extension

Type of Power Extension	Strength
IR Sensor Controlled Power Extension	Reduce the risk of electrical shock
Bluetooth Controlled Power Extension	User may set the timer to switch on/off
Power Extension Cord with USB	Compatible with few gadgets
Portable Extension Cords	Convenient for travelling

3.0 METHODOLOGY

The basic block diagram of the Friendly Power Extension was shown in Figure 1.2. The first control method is by using Android Smartphone which apps called “Arduino Bluetooth Control Device” is used to control the switch and set the timer, the signal from the apps will be sent to the Arduino micro-controller via HC-05 Bluetooth module. Then the relay 4-channel is used to transfer control signals from the Arduino micro-controller to each socket of power extension to achieve the switching on and off action.

The second control method is using the sensor. The sensor used in this project is called Infrared (IR) Sensor that function to control the switch and the signal from the sensor will be transferred to the Arduino microcontroller. Then the micro-controller sends the signal to relay 4-channel to control switching on and off action to the socket’s extension. Actually, the flow is the same as using the smartphone, but just input is different. Lastly, the LCD display is used to display, which switch is on and off.

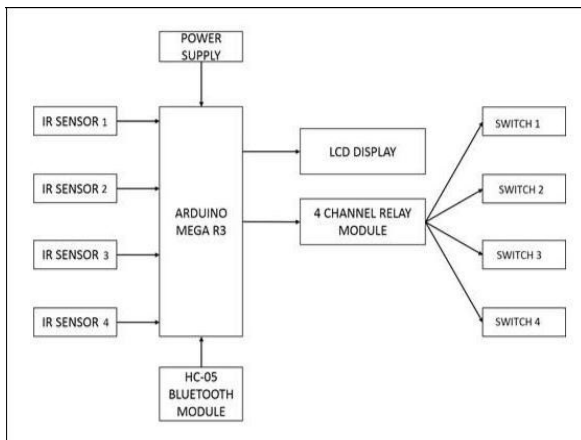


Figure 1.2: Block Diagram of the User - Friendly Power Extension

Schematic Diagram

The function of the schematic diagram is to simulate the circuit project before constructing the real project. There are many software used for simulation of the circuit such as Multisim, Proteus, and Fritzing. For this project, the Proteus software has been used to draw the schematic diagram as shown in Figure 1.3 After selecting and do the connecting of all the components, the circuit was simulated in order to check the circuit functionality.

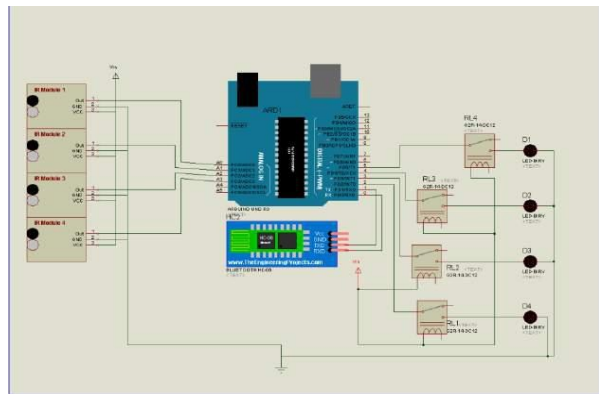


Figure 1.3: Schematic Diagram of the User - Friendly Power Extension

Hardware Development

The hardware development involved a few steps including making the transparent box using transparent acrylic, assembling the components into the box, soldering the components and wiring as shown in Figure 1.4.

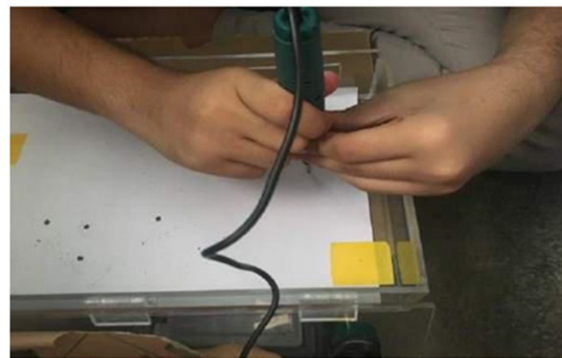


Figure 1.4a: Making a Transparent box of User - Friendly Power Extension

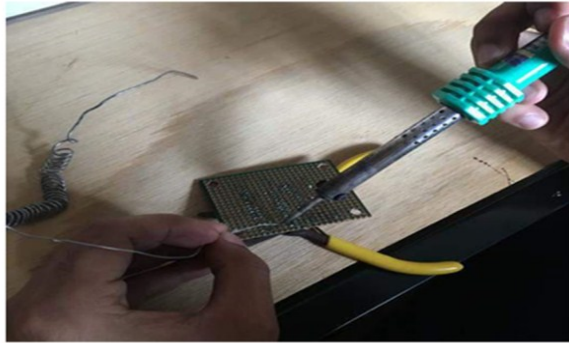


Figure 1.4b: Soldering the Component

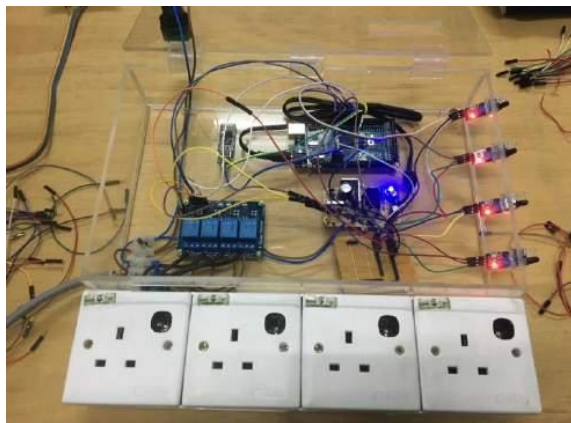


Figure 1.4c: Wiring the Component

Figure
wiring
module



Software Development

The software development started by uploading the coding to Arduino Mega R3 using the Arduino Software as shown in Figure 1.5. Next is to test the functionality of the relay, Bluetooth module, Infrared (IR) sensor test and load test.

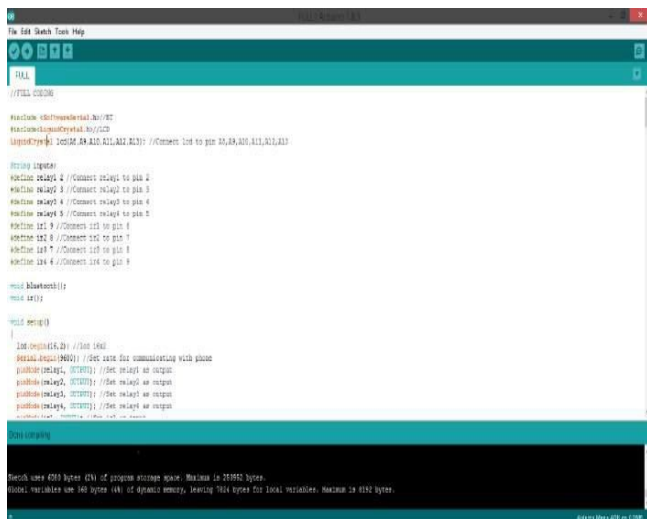


Figure 1.5 Arduino Software

Figure 1.6a: The program to Test Infrared Sensor Module

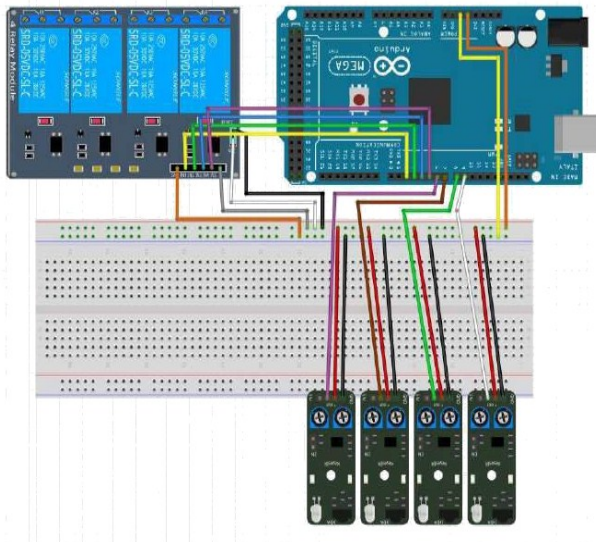


Figure 1.6b: Wiring Diagram to Test Infrared Sensor Module



Figure 1.6d: Testing Load Functionality

4.0 RESULTS

This project is made to upgrade the existing power extension. This project uses two inputs and two outputs, the inputs of this project are a smartphone, which is connected by using HC-05 Bluetooth Module and four Infrared Sensors, one Infrared Sensor will control one switch. For the output, Relay module as a switch of power socket and LCD display is used.

The Arduino Mega 2560 Rev 3 is the main processor of this project, where the inputs and the outputs of this project are being controlled by an Arduino. The input will send the data to the Arduino, and then the Arduino will send the data to the outputs according to the program that has been uploaded to the Arduino. The coding for this project will be attached as Appendix A.

The LCD display is used in this project to display when the switch is turned on. The LCD display will display according to the Arduino. Initially, the switch will be in OFF condition and the LCD will show 'Friendly Extension'. When the user press button 'Switch 1' at the smartphone or the user put a finger in front of the Infrared Sensor 'Switch 1' for a while, the Arduino will turn ON the switch of the socket and the LCD display will show 'SWITCH 1 ON' a while and then the LCD display will show 'FRIENDLY EXTENSION' again. To turn OFF, the user just needs to press again the same button or put the finger in front of the same Infrared Sensor, the Arduino will turn OFF the switch of the socket and the LCD display will show 'SWITCH 1 OFF' for a while and it will show 'FRIENDLY EXTENSION' again. The result will be shown in Figure 1.77 (a), 1.7(b) and 1.7(c).

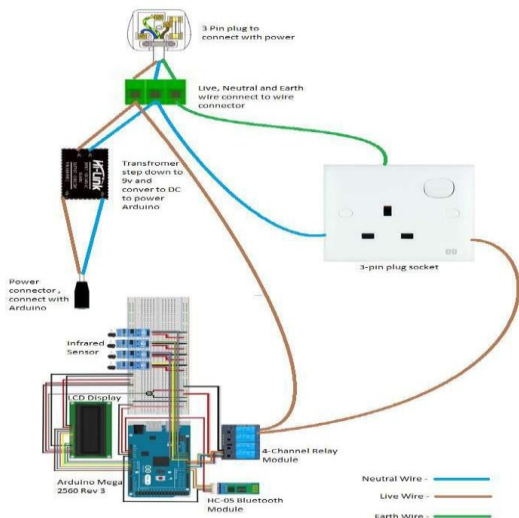


Figure 1.6c: Wiring Diagram to Test Load Functionality



Figure 1.7(a) LCD output for switch 1 and switch 2



Figure 1.7(b) LCD output for switch 3 and switch 4

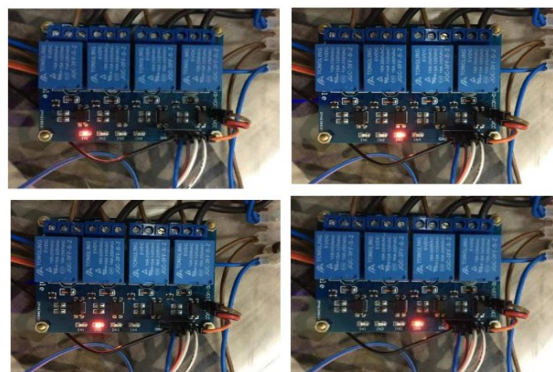


Figure 1.7(c) Relay output for all switches

5.0 CONCLUSION

In conclusion, this project met its objective to produce a user – friendly power extension. The power extension can be controlled either by using a smartphone through Bluetooth application or IR sensor to switch ON/OFF the socket. It used Arduino Mega microcontroller as the main processor of the system together with the Bluetooth module in sending the data and activate the output.

The suggestions are recommended in this project for future research works and development:

1. The system needs to be improved in term of the connection by using another Bluetooth or Wireless module. This module can be connected to more than one device at the same time, even when the wall blocks.
2. This project also can be enhanced further by using the sensor which can detect the object from a long distance. It also can be improved by changing the coding to change the delay for a smooth system.
3. Another future recommendation is by providing a warning buzzer to the user while the extension is switched on without load connection.

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